

**REMARKS**

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, each of the previously considered independent claims (that is, claims 19, 21, 25 and 29) has been amended to recite that ditrimethylolpropane is recovered from a still residue of the distillation (the distillation being recited as one of the steps performed in separating trimethylolpropane). Claim 19 has been further amended to recite that the acid decomposition is performed at a temperature of 20 to "180°C" (note previously considered claims 23 and 26, for example). Claims 21, 25 and 29 have been further amended to recite that ditrimethylolpropane is recovered by subjecting the resulting products of a previously defined step to crystallization or distillation. Claim 21 has been still further amended to recite that the high-boiling components are removed by molecular distillation, using a film evaporator, from the still residue of the distillation for separating trimethylolpropane.

Applicants have added new claims 31 and 32 to the application. Claims 31 and 32 correspond respectively to claims 21 and 25, but each further recite that at least one compound selected from the group consisting of alcohol and hydroxylamine salts is added to the still residue together with at least one of a mineral acid and an organic acid, for the acid decomposition. In connection with claims 31 and 32, note previously considered claims 24 and 28.

In view of amendments to claim 21, as well as in view of the newly added claims 31 and 32, claims 22, 24 and 28 have been cancelled without prejudice or disclaimer.

Initially, entry of the present amendments is respectfully requested. In this regard, it is respectfully submitted that the present amendments do not raise any new issues, including any issue of new matter. For example, noting amendments to claim 21 to recite that the high-boiling components are removed by molecular distillation, using a film evaporator, from the still residue of the distillation for separating trimethylolpropane, note previously considered claim 22, especially together with the description on, e.g., page 8, lines 9-13, of Applicants' specification. Moreover, with respect to amendments to the independent claims to recite that the ditrimethylolpropane is recovered from a still residue of the distillation, and that the last-recited step of crystallization or distillation is for recovering ditrimethylolpropane, it is respectfully submitted that these amendments merely clarify the definition of the present invention, in light of rejections under the second paragraph of 35 USC §112 as set forth for the first time in the Office Action mailed February 3, 2003. It is respectfully submitted that the amendment of claim 19 to recite a temperature of 20-180°C in the acid decomposition corrects a typographical error in claim 1, and is clearly consistent with previous recitations, for example, in previously considered claims 23 and 26. Moreover, as will be discussed *infra*, it is respectfully submitted that the present amendments clearly materially limit issues remaining in connection with the above-identified application, noting particularly the various bases for rejection under 35 USC §112; and, at the very least, present the claims in better form for appeal. Furthermore, noting the bases for rejection under 35 USC §112, set forth for the first time in the Office Action mailed February 3, 2003; and also noting clarifications in connection with the prior art rejection over the

teachings of Great Britain Patent Document No 1, 292, 405 (GB '405), it is respectfully submitted that the present amendments are timely. Notwithstanding that new claims 31 and 32 have been added to the application, it is to be noted that finally rejected claims 22, 24 and 28 have been cancelled without prejudice or disclaimer, so that the number of claims remaining in the application after entry of the present amendments is less than the number of finally rejected claims. Furthermore, noting comments by the Examiner in the fourth full paragraph on page 3 of the Office Action mailed February 3, 2003, it is respectfully submitted that newly added claims 31 and 32 are clearly proper and should be allowed,

In view of all of the foregoing, it is respectfully submitted that Applicants have made the necessary showing under 37 CFR § 1.116(c); and that, accordingly, entry of the present amendments is clearly proper.

The rejection of claim 19 under the first paragraph of 35 USC § 112, the Examiner contending that the recited "80°C", in the "temperature of 20 to 80°C", is nowhere in the specification, is noted. It is respectfully submitted that the recited "80°C" was a typographical error, and this typographical error has been corrected by present amendments to claim 19, reciting a temperature range of 20 to 180°C, consistent with previously considered claims 23 and 26, for example. In view of amendments to the temperature range in claim 19, it is respectfully submitted that the rejection of claim 19 under the first paragraph of 35 USC § 112, set forth in the first two paragraphs on page 2 of the Office Action mailed February 13, 2003, is moot.

Applicants respectfully traverse the rejection of their claims under the second

paragraph of 35 USC § 112, as being indefinite, insofar as this rejection is applicable to the claims as presently amended.

Thus, the Examiner contends that the preamble of claim 21 (as well as claims 25 and 29) recites a process for recovering ditrimethylolpropane, but the body of the claim does not mention a recovering step. As presently amended, the claims recite recovering ditrimethylolpropane by subjecting the resulting products of prior steps to either crystallization or distillation. In view thereof, it is respectfully submitted that this basis for rejection of claims under the second paragraph of 35 USC § 112 is moot.

The additional contention by the Examiner that the steps (i) and (ii) of claim 21 are ambiguous and confusing, for reasons set forth in Items b1 and b2 in the last two paragraphs on page 2 of the Office Action mailed February 3, 2003, is noted. Claim 21 as presently amended expressly recites the step of removing high-boiling components having a higher boiling point than that of dimethylolpropane, by molecular distillation, using a film evaporator, from the residue of the distillation for separating trimethylolpropane; and, thereafter, from a remainder of the still residue which is left, a formal compound contained in this remainder of the still residue is subjected to acid decomposition. It is respectfully submitted that in step i) of claim 21, the formal compound contained in the still residue of the distillation of trimethylolpropane is not separated from the ditrimethylolpropane, because the difference in boiling point between the formal compound and the ditrimethylolpropane is very small. The ditrimethylolpropane and the formal compound are in the overhead in the molecular distillation; and high-boiling

components are in the bottoms of the distillation in step i), leaving the formal compound in the remainder of the still residue, to be treated during the acid decomposition. That is, as a specific answer to a question raised by the Examiner in Item b1, the formal compound contained in the still residue is not separated in the operation of step i) of removing high-boiling components having a higher boiling point than that of ditrimethylolpropane.

The contention by the Examiner in Item b2 at the bottom of page 2 of the Office Action mailed February 3, 2003, with respect to claims 21 and 25, that it is unclear whether "the still residue" in step ii) is the crude or the remaining still residue after i), is noted. The claims have been amended to recite that after removing the high-boiling components or after the crystallization, a remainder of the still residue is left; and that a formal compound contained in the remainder of the still residue is subjected to acid decomposition. Accordingly, it is respectfully submitted that claim 21 (as well as claim 25) is clear with respect to the formal compound being subjected to acid decomposition in processing steps of the present claims. In any event, in light of these amendments to claims 21 and 25, it is respectfully submitted that the basis for rejection of claims 21 and 25 as set forth in Item b2 on page 2 of the Office Action mailed February 3, 2003, is moot.

Reference by the Examiner to claims 1 and 4 in the last three lines on page 2 of the Office Action mailed February 3, 2003, is not understood. Claims 1 and 4 have previously been cancelled, in the Amendment filed October 31, 2002. In addition, reference to claims 19 and 20, in the last line on page 2 of the Office Action mailed February 3, 2003, is not understood. Claim 19 recites that the hydroxylamine

salts are added to the still residue of the distillation which is performed in separating trimethylolpropane, with a formal compound contained in the still residue being subjected to acid decomposition "in the presence of the hydroxylamine salts". It is respectfully submitted that claim 19 is clear with respect to the sequence of adding hydroxylamine salts and the subjecting of the formal compound contained in the still residue to acid decomposition.

As can be seen in the foregoing, as well as from a full review of the claims as presently amended, Applicants have amended their claims in a bona fide attempt to overcome issues raised by the Examiner under 35 USC § 112, in the Office Action mailed February 3, 2003. If the Examiner is of the opinion that any issues remain under 35 USC § 112, first or second paragraph, the Examiner is respectfully requested to contact the undersigned for an interview in connection with the above-identified application, for overcoming any remaining issues. The Examiner is thanked in advance for cooperating with this request.

Applicants respectfully submit that all the claims now presented for consideration by the Examiner patentably distinguish over the teachings of the reference as applied by the Examiner in rejecting claims in the Office Action mailed February 3, 2003, that is, the teachings of Great Britain Patent Document No.1,292,405 (GB '405), under the provisions of 35 USC §103.

Initially, it is noted that only claims 21-23 and 25-27 have been finally rejected over GB '405. Accordingly, the following remarks are only directed to claims 21-23 and 25-27; and, in particular, to claims 21 and 25, the sole independent claims rejected under 35 USC § 103.

It is respectfully submitted that this reference as applied by the Examiner would have neither taught nor would have suggested such a process for recovering ditrimethylolpropane by-produced when producing trimethylolpropane by reacting n-butyraldehyde with formaldehyde in the presence of a basic catalyst, and then separating trimethylolpropane by extraction and distillation, with ditrimethylolpropane being recovered from a still residue of the distillation which is performed in separating trimethylolpropane, the process including, inter alia, removing high-boiling components having a higher boiling point than that of ditrimethylolpropane by molecular distillation, using a film evaporator, from the still residue. See claim 21.

Furthermore, it is respectfully submitted that this reference would have neither taught nor would have suggested such a process for recovering ditrimethylolpropane which includes, inter alia, subjecting the still residue of the distillation for separating trimethylolpropane to crystallization using a solvent, and wherein after such crystallization, which leaves a remainder of the still residue, subjecting a formal compound contained in the remainder of the still residue to acid decomposition. See claim 25.

According to the invention as claimed in claim 21, wherein high-boiling components are removed by molecular distillation, using a film evaporator, large amounts of steam are not necessary for the distillation (compare with GB '405, which uses vacuum steam distillation and requires drainage of large amounts of material). Thus, according to the present invention, the amount of drainage is small because steam need not be added at the time of removal of the high-boiling components having a higher boiling point than that of ditrimethylolpropane, by using a molecular

distillation, by a film evaporator.

In addition, by removing the high-boiling components by crystallization using a solvent, as in claim 25, removal of the high-boiling components is more completely achieved.

GB '405 discloses a method of purifying ditrimethylolpropane, particularly that formed as a by-product in the production of trimethylolpropane by reacting n-butyraldehyde with formaldehyde in an aqueous medium in the presence of an alkaline catalyst. This patent document discloses that when crude ditrimethylolpropane material (containing various formals) is heated together with methanol in the presence of an acid catalyst, there occurs an acetal exchange reaction between the added alcohol and the formals so that the formals of ditrimethylolpropane are converted into ditrimethylolpropane, with a result that ditrimethylolpropane can be isolated and purified easily. See page 1, lines 9-15. Note also the paragraph bridging pages 2 and 3. See also page 3, lines 20-26. This patent document further discloses that after the reaction, the acidic catalyst is neutralized with a suitable alkaline substance such as sodium hydroxide, potassium hydroxide or calcium hydroxide, and then any remaining alcohol is distilled away. See page 3, lines 43-47. This patent document also discloses the use of vacuum distillation with superheated steam either prior to or after the reaction in the presence of the acid catalyst. See the paragraph bridging the left-hand and right-hand columns on page 3.

With respect to that aspect of the present invention set forth in claim 21, note that the high-boiling components having a higher boiling point than that of



ditrimethylolpropane, are removed prior to the acid decomposition, according to the present invention. It is respectfully submitted that this sequence of steps, as in claim 21, has the advantage of removing coloring components which disadvantageously effect the final product, these coloring components being difficult to remove after acid decomposition. In contrast, note Example 1 of the GB '405, disclosing addition of methanol and concentrated sulfuric acid directly to the crude ditrimethylolpropane. It is respectfully submitted that this reference would not have disclosed, nor would have suggested, unexpectedly better results achieved through removal of high-boiling components prior to the acid decomposition. That is, as seen from Applicants' specification, by first removing high-boiling components, coloring components, which are disadvantageous, can be avoided. Note, for example, page 11, lines 5-9, of Applicants' specification. 11 WT R L.

Furthermore, note that GB '405 uses vacuum steam distillation in, e.g., examples thereof. Note, for example, Example 4 of GB '405. This vacuum steam distillation requires relatively large amounts of steam, resulting in a large amount of drainage necessary in the method of GB '405. In comparison, and as discussed previously, the amount of drainage according to the present invention is small, due to use of molecular distillation, using a film evaporator. Particularly in view of this additional advantage, it is respectfully submitted that GB '405 would have neither taught nor would have suggested aspects of the present invention as in claim 21. 7 WT R L.

In addition, it is respectfully submitted that GB '405 is silent with respect to removal of high-boiling components by crystallization using a solvent, as in claim 25. See page 2  
line 11-

It is respectfully submitted that this applied reference would have neither taught nor 15-  
remains in  
Hydrolysis -

would have suggested this aspect of the present invention and advantages thereof, wherein removal of the high-boiling components is more completely achieved.

The contention by the Examiner on page 4, lines 8-11, of the Office Action mailed February 3, 2003, that use of molecular distillation would have been obvious "since it falls under the generic 'vacuum distillation' of GB '405", is respectfully traversed. Note that the teachings of the reference as a whole must be considered. As a whole, GB '405 discloses vacuum distillation, and specifically discloses vacuum steam distillation, which has disadvantages as discussed previously. Clearly, this reference does not disclose, nor would have suggested, advantages of molecular distillation, using a film evaporator, as discussed previously. Particularly in view of these advantages according to the present invention, wherein high-boiling components are removed by molecular distillation, using a film evaporator, without the need of large amounts of steam, it is respectfully submitted that the broad disclosure in GB '405, of vacuum distillation, particularly in light of specific disclosure of vacuum steam distillation, would have neither taught nor would have suggested the present invention.

Contentions by the Examiner with respect to the sequence of steps in claim 21, set forth in the last full paragraph on page 3, and the paragraph bridging pages 3 and 4, of the Office Action mailed February 3, 2003, are noted. However, it is respectfully submitted that GB '405 provides no differentiation in results, with respect to when in the sequence the high-boiling components are removed from the still residue. In view of the unexpectedly better results achieved according to the present invention, in removing coloring components which disadvantageously effect

the final product, these coloring components being difficult to remove after acid decomposition, it is respectfully submitted that Applicants have established unobviousness of this aspect of the present invention.

In view of the foregoing comments and amendments, entry of the present amendments, and reconsideration and allowance of all claims remaining in the application, are respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current Amendment After Final Rejection. The changes are shown in the Attachment captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 396.40405X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



William I. Solomon  
Registration No. 28,565

1300 North Seventeenth Street  
Suite 1800  
Arlington, VA 22209  
Tel.: 703-312-6600  
Fax.: 703-312-6666

WIS/sjg

VERSION WITH MARKINGS TO SHOW CHANGES MADE

19. (Amended) A process for recovering ditrimethylolpropane by-produced when producing trimethylolpropane by reacting n-butyraldehyde with formaldehyde in the presence of a basic catalyst, and then separating trimethylolpropane by extraction and distillation, with ditrimethylolpropane being recovered from a still residue of said distillation, said process for recovering ditrimethylolpropane comprising:

- i) adding hydroxylamine salts to [a] said still residue of [the] said distillation;
- ii) subjecting a formal compound contained in [the] said still residue to acid decomposition in the presence of said hydroxylamine salts, at a temperature of 20 to [80°C] 180°C using at least one of a mineral acid and an organic acid; and
- iii) recovering ditrimethylolpropane from the still residue after said acid decomposition.

21. (Amended) A process for recovering ditrimethylolpropane by-produced when producing trimethylolpropane by reacting n-butyraldehyde with formaldehyde in the presence of a basic catalyst, and then separating trimethylolpropane by extraction and distillation, with ditrimethylolpropane being recovered from a still residue of said distillation, said process for recovering ditrimethylolpropane

comprising:

- i) removing high-boiling components having a higher boiling point than that of ditrimethylolpropane, by molecular distillation, using a film evaporator, from [a] said still residue of [the] said distillation for separating trimethylolpropane; *provides for alkylated U.S. compound*
- ii) after said removing high-boiling components, which leaves a remainder of said still residue, subjecting a formal compound contained in the remainder of said still residue to acid decomposition, whereby resulting products of said acid decomposition are formed; and *in step*
- iii) recovering dimethylolpropane by subjecting the resulting products of ii) to crystallization using a solvent, after said acid decomposition.

25. (Amended) A process for recovering ditrimethylolpropane by-produced when producing trimethylolpropane by reacting n-butyraldehyde with formaldehyde in the presence of a basic catalyst, and then separating trimethylolpropane by extraction and distillation, with ditrimethylolpropane being recovered from a still residue of said distillation, said process for recovering ditrimethylolpropane comprising:

- i) subjecting [a] said still [reside] residue of said [the] distillation for separating trimethylolpropane to crystallization using a solvent;
- ii) after said crystallization, which leaves a remainder of the still residue, subjecting a formal compound contained in the remainder of the still residue to acid decomposition, whereby resulting products of said acid

decomposition are formed; and

- iii) recovering ditrimethylolpropane by subjecting the resulting products of ii) to crystallization, after said acid decomposition.

29. (Amended) A process for recovering ditrimethylolpropane by-produced when producing trimethylolpropane by reacting n-butyraldehyde with formaldehyde in the presence of a basic catalyst, and then separating trimethylolpropane by extraction and distillation, with ditrimethylolpropane being recovered from a still residue of said distillation, said process for recovering ditrimethylolpropane comprising:

- i) subjecting a formal compound contained in [the] said still residue of [the] said distillation for separating trimethylolpropane to acid decomposition;
- ii) removing high-boiling components having a higher boiling point than that of ditrimethylolpropane, by distillation, from the still residue; and
- iii) removing ditrimethylolpropane by subjecting [the] resulting products of ii) to distillation for removal of low-boiling components.